the way the magnet is turned. I now throw the image of the apparatus on the screen. The spiral lines painted on the wheel show which way it turns. I arrange the magnet to draw the molecular stream so as to beat against the upper vanes, and the wheel revolves rapidly, as if it were an over-shot water-wheel. I now turn the magnet so as to drive the molecular stream underneath; the wheel slackens speed, stops, and then begins to rotate the other way, as if it were an under-shot water-wheel. This can be repeated as often as I like to reverse the position of the magnet, the change of rotation of the wheel showing immediately the way the molecular stream is deflected.

This experiment illustrates the last of the phenomena which time allows me to bring before you, attending the passage of the induction spark through a highly exhausted atmosphere. It will now be naturally asked, What have we learned from the phenomena described and exhibited, and from the explanations that have been proposed? We find in these phenomena confirmation of the modern views of matter and energy. The facts elicited are in harmony with the theory that matter is not continuous but composed of a prodigious number of minute particles, not in mutual contact. The facts also are in full accordance with the kinetic theory of gases—to which I have already referred—and with the conception of heat as a particular kind of energy, expressing itself as a rapid vibratory motion of the particles of matter. This alone would be a lesson of no small value. In science every law, every generalisation, however well established, must constantly be submitted to the ordeal of a comparison with newly-discovered phenomena; and a theory may be pronounced triumphant when it is found to harmonise with and to account for facts which, when it was propounded, were still unrecognised or unexplained.

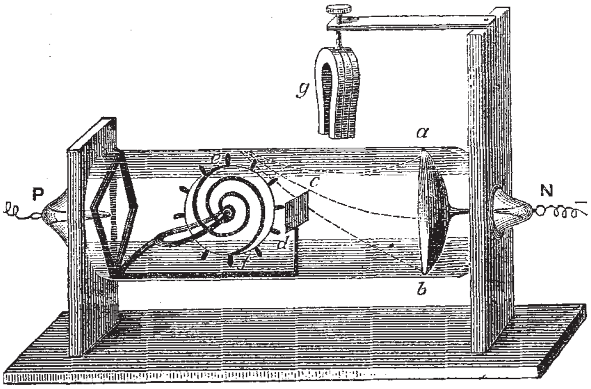

FIG. 19.

But the experiments have shown us more than this: we have been enabled to contemplate matter in a condition hitherto unknown—in a fourth state—as far removed from that of gas as gas is from liquid, where the well-known properties of gases and elastic fluids almost disappear, whilst in their stead are revealed attributes previously masked and unsuspected. In this ultra-gaseous state of matter phenomena are perceived which in the mere gaseous condition are as impossible as in liquids or solids.

I admit that between the gaseous and the ultra-gaseous state there can be traced no sharp boundary; the one merges imperceptibly into the other. It is true also that we cannot see or handle matter in this novel phase. Nor can human or any other kind of organic life conceivable to us penetrate into regions where such ultra-gaseous matter may be supposed to exist. Nevertheless, we are able to observe it and experiment on it, legitimately arguing from the seen to the unseen.

Of the practical applications that may arise out of these researches, it would now be premature to speak. It is rarely given to the discoverer of new facts and new laws to witness their immediate utilisation. The ancients showed a perhaps unconscious sagacity when they selected the olive, one of the slowest growing trees, as the symbol of Minerva, the goddess of Arts and Industry. Nevertheless, I hold that all careful honest research will ultimately, even though in an indirect manner, draw after it, as Bacon said, "whole troops of practical applications."

NOTES

A MEETING of the Executive Committee having charge of the whole arrangements for the approaching visit of the British Association to Sheffield was held the other day. In connection with the Guide Book it was reported that contributions were arranged from Prof. Green, Mr. Arthur Jackson, Mr. F. Brittain, Mr. G. R. Vine, Mr. J. D. Leader, and others. It is proposed to issue the guide books at 1*s*. each, and they will contain scientific and other information suitable for visitors and residents. Dr. Sorby stated that a number of eminent men from foreign countries, including representatives from Germany, Italy, France, Belgium, the United States, and other parts of the world, had accepted invitations to take part in the meetings in Sheffield. These distinguished visitors will represent different branches of science; and from France the British Association is this year to be honoured, after the lapse of a long period, with the presence of the President of the Academy of Sciences, M. Daubrée. The Mayor (Ald. Ward) is to give a banquet to a number of distinguished guests in the banqueting hall of the Cutlers' Company on Saturday, August 23. A reception is to be given by the Master Cutler and Cutlers' Company, which will take place in the Cutlers' Hall on Thursday, August 21. A *soirée* is to be arranged by the local committee for the Tuesday following, also in the Cutlers' Hall. The arrangements for the excursions are being actively carried out. The Duke of Devonshire has invited a limited number of Members of the Association to a luncheon at Chatsworth. Earl Manners has invited a number of excursionists to luncheon at Thoresby, with the additional offer that they should be driven round the forest and park afterwards. Sir Joseph Whitworth has offered hospitality to a party of excursionists visiting Darley Dale and the district, and a similar offer has been made by Mr. F. C. Armitage, as regards a party exploring Arborlowe. The Rev. A. W. Hamilton-Gell invites a number of excursionists to Stanton-in-Peak, with the promise that they should see Router Rocks and other places of interest. Sir John Lubbock is to be asked to give an address at Arborlowe on the interesting Druidical remains there to be seen. Generally the arrangements were reported to be in a very satisfactory state.

SOME weeks since we stated that a committee had been formed for the purpose of raising a fund for the benefit of the widow and family of the late Mr. W. G. Valentin, F.C.S. We understand that many of the friends and former pupils of this well-known chemist have responded with liberality, but as there may be others whom previous appeals have not reached, we have pleasure in stating that subscriptions will still be received by the hon. treasurer of the fund, Mr. F. W. Bayly, Royal Mint, E.

THE success which attended Mr. Tegetmeier's reprint of Boddaert's "Table des Planches Enluminées," and Mr. Dresser's reproduction of Eversmann's Addenda to Pallas's "Zoographia Rosso-Asiatica," has suggested the organisation of a "Willoughby Society for the Reprinting of scarce Ornithological Works," which has accordingly been formed, with every prospect of success. The annual subscription is 1*l*., and no copies of the works reprinted will be sold. The selection of the works to be reprinted by the Society has been intrusted to a committee consisting of the past and present editors of *The Ibis*, and Tunstall's "Ornithologia Britannica" will be the first work reproduced. Particulars may be obtained from the secretary, F. D. Godman, Esq., 10, Chandos Street, Cavendish Square, W.

THE death is announced of Dr. Johann Karl Friedrich Rosenkranz, Professor of Philosophy at Koenigsberg University. Dr. Rosenkranz published a number of philosophical treatises, and was well known through his excellent edition of the works of Immanuel Kant. He died at the age of seventy-four on June 14.

The monument of the late eminent botanist, Prof. Alexander Braun, was unveiled on June 17 at the Botanical Gardens of Berlin. The granite pedestal is by Prof. Adler, the bust of the deceased, which is said to be an excellent likeness, by the well-known sculptor Prof. Schaper.

According to the resolution passed at the last International Congress of Americanists at Luxemburg in 1877, the city of Brussels will be the meeting-place for this year's (third) congress. It will be held from September 23-26 under the protectorate of the King of the Belgians and the honorary presidency of the Count of Flanders. We have before stated the objects of the Congress, which will again be occupied by the consideration and discussion of a series of questions relating to the history, archæology, anthropology, ethnography, linguistics, and palæography of North and South America.

Prof. Virchow, Dr. Schliemann's companion and coadjutor in the latest excavations in the Troad, has written to the eminent Homeric archæologist, informing him of a concurrence of geological opinion at Berlin in the conclusion that all the building stones, fragments of which the professor brought home from Hissarlik, are of fresh-water formation. This conclusion is thought to be decisive against those who affirm the impossibility of identifying Hissarlik with the Homeric Troy, on the ground that at the time of the great epic war the site must have been covered by the sea.

In the Paris Academy of Sciences M. Dausse has been elected a Corresponding Member in the Section of Mechanics, in succession to the late General Didion.

The French Minister of Fine Arts has placed at the disposition of the War Office fourteen cups of Sèvres china to be offered in competition to the societies of carrier-pigeon breeders.

The *Times* Paris correspondent states that Dr. Krauss, at a scientific meeting at Stuttgart a few days ago, referred to the recent swarms of the *Vanessa cardui* butterfly. A like phenomenon occurred in Piedmont in 1741, 1826, and 1857. This year a swarm passed through Turin on June 2, through Switzerland from the 2nd to the 9th, Alsace, France, and Spain from the 5th to the 10th, and Würtemburg from the 11th to the 21st. Prof. Eimer, of Tübingen, found that eighteen out of nineteen specimens were females full of eggs, and he attributes the march to the search for a place to deposit their eggs; a march directed by their keen scent. Caterpillars have already been found on thistles in the districts visited, and a large number may be looked for.

The thirty-sixth annual congress of the British Archæological Association is to be begun at Great Yarmouth on August 11, and continue until the 20th, the last three days, commencing on Monday, August 18, being passed at Norwich. Lord Waveney will deliver an inaugural address at the Town Hall, Great Yarmouth, as president of the meeting, on Monday, August 11, and the following days up to Saturday the 16th will be dedicated to a variety of interesting excursions.

In connection with the celebration of the fiftieth anniversary of the Paris Central School of Arts and Manufactures, the *Gazzetta d'Italia* states that the meeting of engineers connected with the Florentine branch was held on Sunday, and that a banquet was given by the president, Commendatore Prof. Vegni. After dinner those present visited the Workshop Galileo, in which so much is being done for the resuscitation of mechanical art in Florence, with no aid either from Government or the Municipality. Over the door of the workshop is a clock so ingeniously constructed that it has gone now for fourteen months with a loss of only five seconds. A chronograph was exhibited capable of registering the thousandth part of a second, and applicable to the measurement of the velocity of projectiles; a cathetometer capable of measuring heights to the 1,200th of a millimetre, a new electric machine by induction, and a most efficient pneumatic machine, the invention of the eminent Padre Cecchi.

We daresay most of our readers will be pleased at the result of the motion by Mr. S. Lloyd in the House of Commons, on Tuesday, in favour of appointing a Minister of Commerce and Agriculture. The motion was agreed to by a fair majority, among which were members of both sides of the House. This is a step in the right direction.

The Giffard captive balloon has begun its series of night ascents by an experimental trip, which was made on June 30 with great success. The court of the Tuileries was lighted by ten Jablochkoff lamps. It is proposed to carry an electric lamp on the car if the sixty portable Bunsen elements which are in preparation can be carried without inconveniencing passengers. Captive ballooning is making its way in foreign lands. A captive balloon is being fitted up in one of the places of resort round New York; the balance for registering the levitation has been constructed in Philadelphia It can register accurately 10,000 pounds, and is built for sustaining 25,000.

The Paris Exhibition of Sciences Applied to Industry will be opened on the 24th inst. The preparations are being made with great activity in the Palais de l'Industrie. M. Jules Simon, the President of the Council, and M. Nicol, the Director, had an interview, on June 29, with the President of the Republic, to suggest a series of measures intended to promote the success of the exhibition.

Mr. F. W. Moore, eldest son of the late Dr. Moore, has been appointed Curator of the Botanic Gardens, Glasnevin, Dublin. Mr. Moore has been for some time curator of the College Botanic Garden, Dublin.

A Select Committee of the House of Commons, of which Mr. A. Pell was chairman, have concluded their consideration of the Bill promoted by the Liverpool Corporation, to give power to adopt and supply for public and private purposes lighting by electricity. The committee had intimated their decision to pass the Bill if amendments were made in the preamble, the effect of which would be to limit the power of the Corporation to making a scientific experiment, and not allow them to make it a commercial undertaking for purposes of profit, or to compete with the gas company. Amendments were proposed by the Corporation in this direction, and the committee passed the Bill.

It is stated that the Council of India, despairing of obtaining the repeatedly asked-for assistance of the Imperial Government towards defraying the cost of the India Museum, have decided to break it up and to distribute the collections between the British and South Kensington Museums and Kew.

From the report on the forests and plantations in the Island of Mauritius for 1878 we learn that many of the trees which were introduced from India a few years ago have thriven beyond expectation and have in some instances already reached the size of useful timber trees. Among those which have done best are mahogany, teak, and eucalyptus. The last named (*E. calophyllus*) is found to grow with remarkable vigour, and produces fertile seed at a very early age. The severe hurricanes which sweep over the island commit great devastation among the plantations of eucalyptus and other fast-growing trees, and the Government this season intend to plant out a large number of the young gum trees to be grown as large as bushes. In this form they are expected to be able to withstand the force of the wind, and form a screen for the protection of young plantations of timber trees.

On Saturday the Geologists' Association have an excursion to Tunbridge Wells and Crowborough Beacon. On Monday, July 21, and five following days the same society intend to have an outing in the neighbourhood of Ledbury; the Malvern Hills and Woolhope Valley being included in the programme.

In the *Journal de Physique* for June M. Cornu gives an account of his spectroscope designed for observation of ultra-violet radiations. It resembles the common two-prism spectroscope, except in the materials employed, the ordinary materials, crown-glass and flint-glass, absorbing ultra-violet radiations at least from the line O, *i.e.*, from wave-length = 340 millionths of a millimetre. M. Cornu uses quartz for the prisms, and the objective of the collimator (as also of the telescope) is made achromatic; it consists of a biconvex lens of quartz and a divergent plane concave lens of Iceland spar, both cut perpendicularly to the optic axis.

Phosphoric acid has the property of hindering the precipitation of albumen by tannin, but is without action on gelatine. M. Ador lately had the curiosity to try its effect in the tanning of skins, starting with the idea that the pores of skin would remain more open and that the solution of tannin would thus more rapidly coagulate the gelatinous substances, within the skin, producing a more rapid tanning. His experiments, both in the laboratory and on a large scale, are described in the *Moniteur Scientifique* for June. They show that the anticipated effect was realised, and that it allows of the use of a much stronger juice; but there is danger of a loss of weight if the liquids be agitated, by reason of coagulation, outside of the tissues, of a certain quantity of albuminoid principles dissolved by the phosphoric acid, and removed from the skin. He recommends manufacturers to experiment further in the same direction.

M. Robin, the anatomist, who is the only member of the Academy of Sciences who is also in the French Senate, has proposed a bill for instituting an inquiry into the means of increasing the fish production of the French rivers.

In the aëronautical ascent made at Rouen, referred to in our last number, the altitude was 1,200, not 12,000, metres.

The New York correspondent of the *Daily News* telegraphs that Mr. Edison states that since the patents for his electric light were issued he has improved the standard meter for measuring the electricity fed to the burners, and has perfected a method of insulating and conveying the wires from the generating stations to the houses of the consumers. He is satisfied that this generator cannot be improved. 94 per cent., it is said, of horse-power is set free in the electric current, and 82 is delivered in the wire outside of the machine. Eight-ninths of the current is used for the light, and one-ninth is lost in the machine. Mr. Edison's latest experiments give seven gas jets per horse-power, and he expects to increase the number to ten. He says the platinum burner is a settled thing; but, so long as he sees his way to getting more light cut of the horse-power, he will continue his experiments. He expects to perfect his experiments within four weeks.

A catastrophe similar to the one which was happily averted at Teplitz is now feared at the well-known watering-place of Baden, near Vienna. An official investigation committee has been formed, comprising several members of the Geologische Reichsanstalt, and has already begun examining the springs threatened with exhaustion.

We continue to receive the numbers of the *Revista de Canarias*, to which we referred some weeks since. We trust it will meet with the support it deserves, as it is evidently making honest attempts to spread a knowledge and cultivate a taste for science among the inhabitants of the favoured islands. The last number, June 8, contains an article on the Palæontology of the Canaries, by Miguel M. y La-Roche; one on the Hygiene of the Potato, by Lorenzo Lapuyade; another on Primary Instruction in the Canaries, by Juan de la Puerta Causeco.

A violent earthquake is reported from Agram on June 21 at 8.55 A.M., which was repeated on the 22nd at 1.42 A.M. On both occasions the phenomenon consisted of several shocks proceeding in the direction from west to east.

We learn from a Queensland paper that Mr. Walter Hill has been sent on a tour of inspection to Great Sandy, or Fraser, Island, a large irregular-shaped island lying off the coast to the north of the twenty-sixth parallel of south latitude, where it is reported that some valuable timbers flourish, notably the kaurie pine. For some time past the curator of the Botanical Gardens has been giving his attention to the propagation of some of the most valuable timbers indigenous to the colony, and at one place he has formed a nursery of red cedar trees, in which 30,000 plants have been successfully reared and are now all in a flourishing condition. It is believed that a part of Mr. Hill's mission to Fraser Island is to look for suitable sites for arboriculture, with the view of utilising the large number of red cedar plants he has reared. The red cedar takes from sixty to one hundred years to attain its best development, and this care for distant posterity is probably due to thoughtfulness on the part of the authorities who view with alarm the wholesale devastation and waste of the timber which from time to time take place in the colony. It is said that there are yet plenty of cedar trees in the Queensland forests, but quite recently several million feet of this timber were swept out to sea in consequence of a fresh in the Mossman, Daintree, and Johnston rivers.

Careful statistics have been taken in Paris of the cases of rabies observed in 1878. The total number of cases reported to the Prefecture has been 440 dogs, 68 bitches, and 3 cats. Out of these 511 cases 390 were biting rabies. The number of wounds inflicted on persons was 103, and the number of deaths 30—about 1 to 3. This is the same proportion as resulted from previous inquiries. Almost all these cases have been reported from Paris out of a population of 2,000,000. The number of animals which have been bitten by mad dogs is 342 dogs and 24 cats. 234 animals were taken to the veterinary school of Alfort either for autopsy or for inspection.

It is stated that in consequence of the auriferous indications in the Cooktown district, the Queensland Government will offer a reward of 5,000*l*. to stimulate the discovery of a gold-field rich enough to pay the cost of working.

Part V. just issued of the past *Transactions* of the Leicester Literary and Philosophical Society contains the papers read from June, 1850, to June, 1855.

The additions to the Zoological Society's Gardens during the past week include a Grand Galago (*Galago crassicaudata*) from East Africa, presented by Mr. W. Jenkins; a Grivet Monkey (*Cercopithecus griseo-viridis*) from North-East Africa, presented by Mr. R. M. Courage; a Rhesus Monkey (*Macacus erythræus*) from India, presented by Mr. Jas. Bartle; a Puma (*Felis concolor*) from Buenos Ayres, presented by Lord Lilford, F.Z.S.; a Blue-eyed Cockatoo (*Cacatua ophthalmica*) from the Solomon Islands, presented by Lieut.-Col. Arbuthnot, 14th Hussars; a Common Boa (*Boa constrictor*) from South America, presented by Dr. A. Stradling; a Black-faced Spider Monkey (*Ateles ater*), three Red-billed Tree Ducks (*Dendrocygna autumnalis*) from South America, a Collared Fruit Bat (*Cynonycteris collaris*), captured in the Red Sea, two White Storks (*Ciconia alba*), a Common Whimbrel (*Numenius phæopus*), European, a Reticulated Python (*Python reticulatus*) from Manilla, purchased; an Axis Deer (*Cervus axis*), born in the Gardens.